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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/595,686	12/27/2006	Jin Ho Choy	1751-405	4723

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EXAMINER
LEE, REBECCA Y

ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
02/01/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTO-PAT-Email@rfem.com

Office Action Summary	Application No.	Applicant(s)	
	10/595,686	CHOY ET AL.	
	Examiner	Art Unit	
	REBECCA LEE	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 November 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-7,10 and 13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-2, 4-7, 10, 13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/16/09 has been entered.

Status of Claims

Claims 3, 8-9 and 11-12 are cancelled. Claims 1-2, 4-7, 10 and 13 are pending where claims 1-2, 10 and 13 are amended in view of amendment filed 10/14/09.

Status of Previous Rejections

The rejections of claims 1-2, 4-7, 10 and 13 under 35 U.S.C. 103(a) have been maintained.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 4, 6 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tian et al. ("Biomimetic Arrays of Oriented helical ZnO nanorods and Columns", JACS, 2002, 124, 12954-12955) in view of Boyle et al. ("Novel low temperature solution deposition of perpendicularly oriented rods of ZnO: substrate effects and evidence of the importance counter-ions in the control of crystal growth", Chem. Commun, 2002, 80-81).

Regarding claims 1 and 10, Tian et al. teaches a method of forming a ZnO nanorod array by first depositing ZnO nanoparticles on a substrate, and then the substrate is placed in a solution containing HMT, Zn nitrate and a solvent to grow the ZnO nanorod arrays at 95°C (Column 1, lines 27-36), which indicates the ZnO nanoparticles served as both a buffer layer and a seed layer as claimed.

Tian et al. does not disclose the substrates recited in the claims.

Boyle et al. discloses nanophase ZnO would be grown on sapphire (Al_2O_3) substrate (Column 1, lines 15-21).

It would have been obvious to choose sapphire (Al_2O_3) substrate for growing ZnO nanorod arrays from a finite number of identified substrates (it would have been "obvious to try" the specific substrate to grow ZnO nanorod array and obtain the predictable result). In addition, this type of substrate is well known in the art to grow ZnO nanorods and the skilled artisan would have clearly appreciated that one can employ conventional substrates according to the Tian et al. in view of Boyle et al. absence evidence of criticality. Finally, the substitution of one type of substrate for

another that is known to be used for the same purpose is clearly within the scope of the skilled artisan.

With respect to the amended feature of "consisting of" in claim 1 and 10, even though the nutrition solution of Tian et al. further comprises sodium citrate, eliminating a non-essential element is prima facie obviousness MPEP 2144.04.

Regarding claim 4, Tian et al. discloses the nutrient solution contains 0.03M Zn nitrate and 0.1 HMT (Column 1, lines 33-36), which falls within the claimed volume ratio range.

Claim 6 is a product by process claim. The claimed nanorod array appears to be substantially identical with the one made by Tian ei al. in view of Boyle et al., since the process of making would be obvious over Tian et al. in view of Boyle et al. (MPEP 2113).

Claims 1, 4 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boyle et al. ("Novel low temperature solution deposition of perpendicularly oriented rods of ZnO: substrate effects and evidence of the importance counter-ions in the control of crystal growth", Chem. Commun, 2002, 80-81).

Regarding claim 1, Boyle et al. disclose a method of forming a ZnO nanorod array by coating on a substrate ZnO particles serving both as a buffer layer and a seed layer; growing and forming ZnO nanorod array at 90 °C in a nutrient solution containing

HMT, zinc acetate and a solvent (excremental section), wherein the substrate would be sapphire (Al_2O_3) substrate (Column 1, lines 15-21).

With respect to the recited transitional phase of "consisting of", even though Boyle et al. disclose HCl is added dropwise (experimental section), with HCl added is in negligible amount, or being part of the solvent, the nutrition solution of Boyle et al. still reads on instant claims.

Regarding claim 4, Boyle et al. disclose the volume ratio of Zn acetate to HMT is around 1:1, which falls within the claimed range.

Regarding claim 6, it is a product by process claim. The claimed nanorod array appears to be substantially identical with the one made by Boyle et al., since the process of making is obvious over Boyle et al. (MPEP 2113).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable Boyle et al. ("Novel low temperature solution deposition of perpendicularly oriented rods of ZnO: substrate effects and evidence of the importance counter-ions in the control of crystal growth", Chem. Commun, 2002, 80-81) in view of over Tian et al. ("Biomimetic Arrays of Oriented helical ZnO nanorods and Columns", JACS, 2002, 124, 12954-12955).

Boyle et al. teach the zinc source in the nutrition solution is zince acetate, but do not expressly teach the zinc source would be zinc nitrate.

Tian et al. teach zinc nitrate would be used as a zinc source to form ZnO nanorod array (Column 1, lines 27-36).

Therefore, zinc acetate and zinc nitrate are functional equivalent in terms of being a zinc source in the process of making ZnO nanorod arrays. It is well held that substituting functional equivalents are prima facie obviousness MPEP2144.06. Thus, in the instant case, substituting the zinc acetate of Boyle et al. with the zinc nitrate of Tian et al. is prima facie obviousness.

Claims 2, 5, 7 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tian et al. ("Biomimetic Arrays of Oriented helical ZnO nanorods and Columns", JACS, 2002, 124, 12954-12955) in view of Boyle et al. ("Novel low temperature solution deposition of perpendicularly oriented rods of ZnO: substrate effects and evidence of the importance counter-ions in the control of crystal growth", Chem. Commun, 2002, 80-81) and Ren et al. (US7294417).

Regarding claims 2 and 13, Tian et al. teaches a method of forming a ZnO nanorod (array) by first depositing ZnO nanoparticles on substrate, then the substrate is placed in a solution containing zinc nitrate, sodium citrate and a solvent to grow the ZnO nanorod arrays at 95°C (Column 1, lines 27-36), which indicates the ZnO nanoparticles serve both as a buffer layer and a seed layer as claimed.

Tian et al. does not disclose the substrates recited in the claims.

Boyle et al. discloses nanophase ZnO would be grown on sapphire (Al_2O_3) substrate (Column 1, lines 15-21).

It would have been obvious to choose sapphire (Al_2O_3) substrate for growing ZnO nanorod arrays from a finite number of identified substrates (it would have been "obvious to try" the specific substrate to grow ZnO nanorod array and obtain the predictable result). In addition, this type of substrate is well known in the art to grow ZnO nanorods and the skilled artisan would have clearly appreciated that one can employ conventional substrates according to the Tian et al. in view of Boyle et al. absence evidence of criticality. Finally, the substitution of one type of substrate for another that is known to be used for the same purpose is clearly within the scope of the skilled artisan.

Tian et al. does not specifically teach the nutrient solution would contain zinc acetate as claimed instead of zinc nitrate.

Boyle et al. discloses ZnO nanorods would be grown from zinc acetate (experimental section).

Therefore, zinc acetate and zinc nitrate are functional equivalent in terms of being a zinc source in the process of making ZnO nanorod arrays. It is well held that substituting functional equivalents are prima facie obviousness MPEP2144.06. Thus, in the instant case, substituting the zinc nitrate of Tian et al. with the zinc acetate of Boyle et al. is prima facie obviousness.

Tian et al. does not specifically teach the method would be used to synthesize a nanowall array.

Ren et al. teaches methods to synthesize ZnO of varied nanostructure morphologies on a substrate, like nanowall and nanorod (Column 2, lines 24-32 and 52-59). It is examiner's position that nanowall and nanorods are obvious variances absence evidence to the contrary. One of ordinary skill in the art would have appreciated either form of ZnO nanostructure base on industrial needs and applicability.

With respect to the amended feature of "consisting of" in claim 2 and 13, even though the nutrition solution of Tian et al. further comprises HMT, eliminating a non-essential element is prima facie obviousness MPEP 2144.04.

Regarding claim 5, the combined references do not specifically teach the volume ratio of Zn acetate to sodium citrate is 10:1 to 1:10.

However, it is well held that discovering an optimum value of a result effective variable requires only routine skill in the art MPEP 2144.05 II. In the instant case, the ratio of Zn acetate to sodium citrate is a result effective variable since Tian et al. teach sodium citrate could control the growth behavior of the crystal; citrate ions could specifically adsorb (002) surface and force the crystal to grow into plates (column 1, lines 8-13). Thus, it could have been obvious to one of ordinary skill in the art at the time the invention was made to have optimized the volume ratio between zinc acetate to sodium citrate in order to achieve desirable structure of the ZnO array.

Claim 7 is a product by process claim. The claimed nanowall array appears to be substantially identical with the one made by Tian ei al. in view of Boyle et al. and Ren et

al., since the process of making is obvious over Tian et al. in view of Boyle et al. and Ren et al. (MPEP 2113).

Response to Arguments

Applicant's arguments with respect to the amended feature of "consisting of" in claims 1-2 have been considered but are moot in view of the new ground(s) of rejection. The claimed nutrient solution with limited components has been addressed above.

Applicant's remaining arguments filed 10/14/09 have been fully considered but they are not persuasive.

Applicant compares the X-ray diffraction pattern of the claimed ZnO nanorod array with the nanorod arrays of Boyle et al.; and asserts unexpected results are obtained by the claimed method. The examiner would like to remind the applicant that any objective evidence such as unexpected result must be factually supported by an appropriate affidavit or declaration to be of probative value. See In re De Blauwe, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984) and MPEP 716.01(c). Evidence of unexpected properties may be in the form of a direct or indirect comparison of the claimed invention with the closest prior art which is commensurate in scope with the claims. See See In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) and MPEP § 716.02(d) - § 716.02(e). Since the proof of factual evidence is lacking in applicant's assertion of unexpected results, the examiner does not find the argument persuasive. In addition, applicant's comparison is not commensurate with the scope of the invention

because independent claims 1-2 do not limit the substrate to be Si-wafer only which Figs 2-3 of the instant specification reflects ZnO nanorod on a Si substrate only.

Applicant also argues the X-ray data of Tian, Boyle and Ren appear to be different compared to the instant invention. However, nonobviousness can not be shown by attacking references individually where the rejections are based on combinations of references. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In the instant case, the rejection is based on the combination of Tian, Boyle and Ren, thus, one of ordinary skill in the art would have expecetd the X-ray data of Tian in view of Boyle and Ren would have a similar pattern as instant invention.

Applicant also argues Ren et al. disclose a different method from claimed. However, the claimed method is covered by Tian et al. and Boyle et al., examiner only relies on Ren et al. to show nanorod and nanowall arrays would have been made by a same method. Thus, applicant's argument is not convincing.

Conclusion

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to REBECCA LEE whose telephone number is (571)270-5856. The examiner can normally be reached on Monday-Friday 8:00 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ROY KING can be reached on (571)272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. L./
Examiner, Art Unit 1793

/Roy King/
Supervisory Patent Examiner, Art Unit 1793